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JC960 U.S. PTO

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A

Practitioner's Docket No. 55413

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

JC960 U.S. PTO
09/718669
11/22/00

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of

Inventor(s): **Po-Hao YUAN, Chi-Chuan WU and Chih Shun CHEN**

WARNING: 37 CFR 1.41(a)(1) points out:

“(a) A patent is applied for in the name or names of the actual inventor or inventors.

(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(i) is filed supplying or changing the name or names of the inventor or inventors.”

For (title): **TAPE CARRIER PACKAGE STRUCTURE WITH DUMMY PADS AND DUMMY LEADS FOR PACKAGE REINFORCEMENT**

CERTIFICATION UNDER 37 C.F.R. 1.10*
(Express Mail label number is **mandatory**.)
(Express Mail certification is optional.)

I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on this date November 22, 2000, in an envelope as “Express Mail Post Office to Addressee,” mailing Label Number **EL770089848US**, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Deanna M. Rivernider
(type or print name of person mailing paper)
Deanna M. Rivernider
Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

***WARNING:** Each paper or fee filed by “Express Mail” **must** have the number of the “Express Mail” mailing label placed thereon prior to mailing. 37 C.F.R. 1.10(b).
“Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition.” Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

1. Type of Application

This new application is for a(n)

(check one applicable item below)

☒ Original (nonprovisional)

☐ Design

☐ Plant

WARNING: Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

WARNING: Do not use this transmittal for the filing of a provisional application.

NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

☐ Divisional.

☐ Continuation.

☐ Continuation-in-part (C-I-P).

2. Benefit of Prior U.S. Application(s) (35 U.S.C. 119(e), 120, or 121)

NOTE: A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. 112. Each prior application must also be:

(i) An international application entitled to a filing date in accordance with PCT Article 11 and designating the United States of America; or

(ii) Complete as set forth in § 1.51(b); or

(iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(d) and include the basic filing fee set forth in § 1.16; or

(iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(l) within the time period set forth in § 1.53(f).

37 CFR 1.78(a)(1).

NOTE If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

WARNING: *If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.*

WARNING: *When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application **must** be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).*

☐ The new application being transmitted claims the benefit of prior U.S. application(s).
Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE
BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed

A. Required for Filing Date under 37 C.F.R. 1.53(b) (Regular) or 37 C.F.R. 1.153 (Design) Application

 7 Pages of Specification (including cover sheet)
 3 Pages of Claims
 3 Sheets of Drawing

☐ Formal
☐ Informal

B. Other Papers Enclosed

 1 Pages of Abstract
 Other

WARNING: ***DO NOT** submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. For comments on proposed then-new 37 C.F.R. 1.84, see Notice of March 9, 1988 . . . (1990 O.G. 57-62).*

NOTE: *"Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page." 37 C.F.R. 1.84(c).*

(complete the following, if applicable)

☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. 1.84(b).

4. Additional Papers Enclosed

- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement (37 C.F.R. 1.98)
- ☐ Form PTO-1449
- ☐ Citations
- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other:

5. Declaration or Oath

NOTE: *A newly executed declaration is not required in a continuation or divisional application provided the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47 then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 CFR 1.63(d).*

NOTE: *A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name, including the family name, and at least one given name without abbreviation together with any other given name or initial, and the residence, post office address and country of citizenship of each inventor and state whether the inventor is a sole or joint inventor. 37 CFR 1.63(a)(1)-(4).*

☒ Enclosed

Executed by

(check all applicable boxes)

- ☒ inventor(s).
- ☐ legal representative of inventor(s). 37 CFR 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
- ☐ This is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. See item 13 below for fee.

☐ Not Enclosed.

NOTE: *Where the filing is a completion in the U.S. of an International Application, or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.*

- ☐ Application is made by a person authorized under 37 C.F.R. 1.41(c) on behalf of all the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 CFR 1.16(e), can be filed subsequently).

NOTE: It is important that all the correct inventor(s) are named for filing under 37 CFR 1.41(c) and 1.53(b).

☐ Showing that the filing is authorized.
(not required unless called into question. 37 CFR 1.41(d))

6. Inventorship Statement

WARNING: If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

☐ The same.
or
☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,
☐ is submitted.
☐ will be submitted.

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of \$130.00 required by 37 CFR 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 CFR 1.52(d).

☒ English
☐ Non-English

☐ The attached translation includes a statement that the translation is accurate. 37 C.F.R. 1.52(d).

8. Assignment

☒ An assignment of the invention to Siliconware Precision Industries Co., Ltd.
of Taichung, Taiwan

☒ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☒ FORM PTO 1595 is also attached.
☐ was filed in the parent application
☐ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters-one for the application and one for the assignment" Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: A newly executed "STATEMENT UNDER 37 CFR 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

9. **Certified Copy**

Certified copy(ies) of application(s)

Country _____ **Appln. No.** _____ **Filed** _____

from which priority is claimed

- ☐ is enclosed.
☐ was filed.
☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. **Fee Calculation (37 C.F.R. 1.16)**

A. ☒ Regular application

CLAIMS AS FILED					
Claims	Number Filed	Basic Fee Allowance	Number Extra	Rate	Basic Fee 37 C.F.R. 1.16(a) \$710.00
Total Claims (37 CFR 1.16(c))	12	- 20 =	0	x \$ 18.00	\$0
Independent Claims (37 CFR 1.16(b))	3	- 3 =	0	x \$78.00	\$0
Multiple Dependent Claim(s), if any (37 CFR 1.16(d))			+	\$260.00	\$0

- ☐ Amendment canceling extra claims is enclosed.
☐ Amendment deleting multiple-dependencies is enclosed.
☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation \$ 710.00

- B. ☐ Design application
(\$330.00—37 CFR 1.16(f))
Filing Fee Calculation \$_____
- C. ☐ Plant application
(\$540.00—37 CFR 1.16(g))
Filing Fee Calculation \$_____

11. Small Entity Statement(s)

- ☐ Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is (are) attached.

WARNING: *"Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refiling of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 CFR 1.28(a)(2).*

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application _____, filed on _____ from which benefit is being claimed for this application under:

35 U.S.C. § ☐ 119(e),
☐ 120,
☐ 121,
☐ 365(c),

and which status as a small entity is still proper and desired.

- ☐ A copy of the statement in the prior application is included.
Filing Fee Calculation (50% of A, B or C above) \$_____

NOTE: *Any excess of the full fee paid will be refunded if a small entity status is established refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 CFR 1.28(a).*

12. Request for International-Type Search (37 C.F.R. 1.104(d))
(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time.
(This and the surcharge required by 37 C.F.R. 1.16(e) can be paid subsequently.)

☒ Enclosed

☒ Filing fee \$ 710.00

☒ Recording assignment
(\$40.00; 37 C.F.R. 1.21(h))
(See attached "COVER SHEET FOR
ASSIGNMENT ACCOMPANYING NEW
APPLICATION.") \$ 40.00

☐ Petition fee for filing by other than
all the inventors or person on behalf
of the inventor where inventor
refused to sign or cannot be reached
(\$130.00; 37 C.F.R. 1.47 and 1.17(i)) \$ _____

☐ For processing an application with a
specification in a non-English language
(\$130.00; 37 C.F.R. 1.52(d) and 1.17(k)) \$ _____

☐ Processing and retention fee
(\$130.00; 37 C.F.R. 1.53(d) and 1.21(l)) \$ _____

☐ Fee for international-type search report
(\$40.00; 37 C.F.R. 1.21(e)) \$ _____

NOTE: 37 CFR 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 CFR 1.53(f) and this, as well as the changes to 37 CFR 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from notification under § 53(f).

Total Fees Enclosed \$ 750.00

14. Method of Payment of Fees

☒ Check in the amount of \$ 750.00

☐ Charge Account No. _____ in the amount of \$ _____.
A duplicate of this transmittal is attached.

15. Authorization to Charge Additional Fees

WARNING: If no fees are to be paid on filing, the following items should not be completed.

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 04-1105.

- ☒ 37 C.F.R. 1.16(a), (f) or (g) (filing fees)
☒ 37 C.F.R. 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

- ☒ 37 C.F.R. 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)
☒ 37 CFR 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a).
☒ 37 C.F.R. 1.17 (application processing fees)

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 CFR 1.136(a)(3).

- ☐ 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b)).

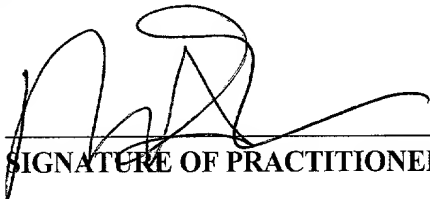
NOTE: 37 CFR 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . issue fee." From the wording of 37 CFR 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

16. Instructions as to Overpayment

NOTE: "... Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 CFR 1.26(a).

☒ Credit Account No. 04-1105

☐ Refund


SIGNATURE OF PRACTITIONER

Reg. No. 33,860

Peter F. Corless

(type or print name of practitioner)

EDWARDS & ANGELL, LLP

Dike, Bronstein, Roberts & Cushman, IP Group

Tel. No.: (617) 523-3400

130 Water Street

P.O. Address

Customer No.:

Boston, MA 02109

[X] Incorporation by reference of added pages

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)

[] Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added _____

[] Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added _____

[] Plus added pages deleting names of inventor(s) named on prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added _____

[X] Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added 2

[] Statement Where No Further Pages Added

(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)

[] This transmittal ends with this page.

TAPE CARRIER PACKAGE STRUCTURE WITH DUMMY PADS AND DUMMY LEADS FOR PACKAGE REINFORCEMENT

BACKGROUND OF THE INVENTION

1. Field of the Invention:

5 This invention relates to integrated circuit packaging technology, and more particularly, to a tape carrier package (TCP) structure with dummy pads and dummy leads for reinforcement of the package construction.

2. Description of Related Art:

10 TCP (Tape Carrier Package) is an advanced type of integrated circuit packaging technology which is characterized in the use of a tape carrier, rather than a leadframe or a substrate, as the chip-mounting base, and also in the use of TAB (Tape Automated Bonding) technology to implement the overall packaging process. The tape carrier is typically formed with a device hole for accommodating the packaged semiconductor chip, and a plurality of inner leads bonded to the I/O pads of the packaged semiconductor chip to serve as external
15 connecting means for the packaged semiconductor chip. A conventional TCP structure is illustratively depicted in the following with reference to FIGs. 1A-1D.

Referring to FIG. 1A, the conventional TCP structure is used to pack a semiconductor chip 110 having a plurality of I/O pads 111 arranged along the four sides thereof (note that FIGs. 1A-1C are simplified to show only a small number of bond pads and those
20 parts that are related to the invention for demonstration purpose; the actual circuit layout of the TCP structure may be much more complex).

By the conventional TCP technology, however, no I/O pads are arranged on the four corners 110a, 110b, 110c, 110d of the semiconductor chip 110 (the four corners 110a, 110b, 110c, 110d are indicated by the dotted circles in FIG. 1A).

25 Referring further to FIG. 1B, the conventional TCP structure is constructed on a tape carrier 120, such as a TAB tape, which is formed with a centrally-located device hole

Referring further to FIG. 1B, the semiconductor chip 110 of FIG. 1A is to be mounted on a tape carrier 120, such as a TAB tape, which is formed with a centrally-located device hole 120a and is predefined with a plurality of lead-bonding areas 121 surrounding the device hole 120a (the areas indicated by the dotted rectangular boxes in FIG. 1B)

5 Referring further to FIG. 1C, during assembly, the first step is to mount the semiconductor chip 110 of FIG. 1A in the device hole 120a of the tape carrier 120 of FIG. 1B. As the semiconductor chip 110 is mounted in position, an ILB (Inner Lead Bonding) process is performed to bond a set of electrically-conductive inner leads 130 between the respective I/O pads 111 on the semiconductor chip 110 and the lead-bonding areas 121 on the tape carrier 120 to serve as external connecting means for the packaged semiconductor chip 110.

10 Referring further to FIG. 1D, in the next step, an encapsulation process is performed to dispense an encapsulation material, such as resin, through the gaps between the inner leads 130 into the device hole 120a so as to form an encapsulation body 140 to encapsulate the semiconductor chip 110.

15 In practical realization, however, the foregoing conventional TCP technology has the following drawbacks.

First, since the four corners 110a, 110b, 110c, 110d of the semiconductor chip 110 are provided with no bond pads and unconnected to any leads, these four corners 110a, 110b, 110c, 110d of the semiconductor chip 110 would be nearly unsupported. As a result, 20 during the ILB process, it would easily cause cracking of the inner leads 130. In addition, during the movement of the tape carrier 120, it would easily cause the package construction to be subjected to deformation.

Second, during the potting process, since the corner-situated lead gap width (denoted by W in FIG. 1B) is considerably greater than the pitch of the side-situated inner leads 130 (denoted by P in FIG. 1B), it would cause the potting of the encapsulation material 25 through these inner leads 130 during the encapsulation process to be unevenly distributed to the back side of the semiconductor chip 110, which would easily cause undesired forming of

140 would be easily subjected to popcorn effect and delamination, thus degrading the quality and reliability of the finished TCP product.

SUMMARY OF THE INVENTION

5 It is therefore an objective of this invention to provide an improved TCP technology which allows the corners of the packaged semiconductor chip to be firmly supported.

It is another objective of this invention to provide an improved TCP technology which allows the encapsulation material to be substantially evenly distributed to the back side of the packaged semiconductor chip, so as to allow the resulted encapsulation body to
10 be substantially free of voids for prevention of undesired popcorn effect and delamination.

It is still another objective of this invention to provide an improved TCP technology which would prevent the package construction from being deformed during movement of the tape carrier.

In accordance with the foregoing and other objectives, the invention proposes an
15 improved TCP structure.

Broadly recited, the TCP structure of the invention comprises the following constituent components: (a) a semiconductor chip having: (a1) a plurality of I/O pads arranged along the sides thereof; and (a2) a plurality of dummy pads arranged on the corners thereof; (b) a tape carrier having a device hole and a plurality of side-situated lead-bonding areas and
20 corner-situated lead-bonding areas surrounding the device hole; (c) a set of inner leads, including: (c1) a group of I/O leads, which are bonded between the respective I/O pads on the semiconductor chip and the side-situated lead-bonding areas on the tape carrier; and (c2) a group of dummy leads, which are bonded between the respective dummy pads on the semiconductor chip and the corner-situated lead-bonding areas on the tape carrier.

25 During assembly, since dummy leads are bonded between the dummy pads and the corner-situated lead-bonding areas, the corners of the semiconductor chip can be firmly supported in addition to the lateral support of the semiconductor chip by the functional I/O

leads, thus reinforcing the package construction. During the inner-lead bonding (ILB) process, such reinforcement can help prevent the cracking of any of the I/O leads. Moreover, during encapsulation process, since the provision of the dummy leads can help reduce the lead gap width at the four corners of the device hole, it can help the encapsulation material to be more evenly distributed to the back side of the semiconductor chip, thus preventing the undesired forming of voids in the resulted encapsulation body, making the resulted encapsulation body less likely to be subjected to popcorn effect and delamination. In addition, it can help provide a uniform package height (UPH) to the overall package construction. These advantages allow the finished TCP product to be more assured in quality and reliability than prior art.

BRIEF DESCRIPTION OF DRAWINGS

The invention can be more fully understood by reading the following detailed description of the preferred embodiments, with reference made to the accompanying drawings, wherein:

FIG. 1A (PRIOR ART) shows a schematic top view of a conventional semiconductor chip;

FIG. 1B (PRIOR ART) shows a schematic top view of an individual TCP unit for packaging the semiconductor chip of FIG. 1A;

FIG. 1C (PRIOR ART) shows a schematic cross-sectional view of the TCP construction of FIG. 1C after being encapsulated;

FIG. 2A shows a schematic top view of a semiconductor chip with dummy pads according to the invention;

FIG. 2B shows a schematic top view of an individual TCP unit for packaging the semiconductor chip of FIG. 2A according to the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

A preferred embodiment of the improved TCP structure according to the invention is disclosed in full details in the following with reference to FIGs. 2A-2B.

Referring to FIG. 2A, the improved TCP structure according to the invention is used
5 to pack a semiconductor chip **210** having a plurality of functional I/O pads **211** arranged along the four sides thereof. It is an important aspect of the invention that the semiconductor chip **210** is further formed with a plurality of non-functional dummy pads **212** on the four corners **210a**, **210b**, **210c**, **210d** thereof (note that FIGs. 2A-2B are simplified to show only a small number of I/O pads and dummy pads and those parts that are related to the invention;
10 the actual circuit layout of the TCP structure may be much more complex).

In this embodiment, for example, the semiconductor chip **210** is an LCD (Liquid Crystal Display) driver chip; and the I/O pads **211** and the dummy pads **212** are made of aluminum. However, broadly recited, the semiconductor chip **210** can be any of various other types of semiconductor chips, while the I/O pads **211** and the dummy pads **212** can be
15 made of any of various other suitable electrically-conductive materials.

Referring further to FIG. 2B, the TCP structure of the invention is constructed on a tape carrier **220** having a centrally-located device hole **220a** and predefined with a plurality of side-situated lead-bonding areas **221** along the four sides of the device hole **220a** and a plurality of corner-situated lead-bonding areas **222** on the corners of the device hole **220a**.
20 The side-situated lead-bonding areas **221** are pre-bonded with a first group of inner leads **231** serving as I/O leads, while the corner-situated lead-bonding areas **222** are pre-bonded with a second group of inner leads **232** serving as dummy leads.

During assembly, the semiconductor chip **210** of FIG. 2A is mounted in the device hole **220a** of the tape carrier **220** of FIG. 2B. As the semiconductor chip **210** is mounted in
25 position, an ILB (Inner Lead Bonding) process is performed to bond the I/O leads **231** to the

functional I/O pads **211** on the semiconductor **210** and meanwhile bond the dummy leads **232** to the non-functional dummy pads **212**.

Preferably, the dummy leads **232** are spaced at the same pitch as the I/O leads **231**, so that the pitch of the total set of the I/O leads **231** and the dummy leads **232** can be substantially equally spaced. This lead arrangement scheme can help facilitate the subsequent potting of encapsulation material through these I/O leads **231** and dummy leads **232** to be evenly distributed to the back side of the semiconductor chip **210**, thereby preventing the undesired forming of voids in the resulted encapsulation body (not shown), so that the resulted encapsulation body (not shown) would be less likely subjected to popcorn effect and delamination.

The bonding of the dummy leads **232** between the dummy pads **212** and the corner-situated lead-bonding areas **222** can help provide a firm support to the four corners **210a**, **210b**, **210c**, **210d** of the semiconductor chip **210** in addition to the lateral support of the semiconductor chip **210** by the I/O leads **231**, thereby reinforcing the mounting of the semiconductor chip **210** on the tape carrier **220**. During the ILB process, such reinforcement can help prevent the cracking of any of the I/O leads **231**.

Subsequently, an encapsulation process is performed by potting an encapsulation material, such as resin, through the gaps between the I/O leads **231** and the dummy leads **232** into the device hole **220a** so as to form an encapsulation body (not shown) to encapsulate the semiconductor chip **210**.

During the encapsulation process, since the provision of the dummy leads **232** can help reduce the lead gap width at the four corners of the device hole **220a**, it can help the encapsulation material to be more evenly distributed to the back side of the semiconductor chip **210**, thus preventing the undesired forming of voids in the resulted encapsulation body (not shown), making the resulted encapsulation body (not shown) less likely to be subjected to popcorn effect and delamination. Moreover, it can help provide a uniform package height (UPH) to the overall package construction.

During the movement of the tape carrier tape carrier 220, the total set of the I/O leads 231 and the dummy leads 232 can provide a firm support to the entirety of the semiconductor chip 210, so that it can help prevent the package construction from subjecting to warpage due to the stress from the movement.

5 In conclusion, the invention provides an improved TCP technology which is characterized in the provision of dummy pads and dummy leads to help reinforce the structural strength of the package construction. During assembly, since dummy leads are bonded between the dummy pads and the corner-situated lead-bonding areas, the corners of the semiconductor chip can be firmly supported in addition to the lateral support of the semiconductor chip by the functional I/O leads, thereby reinforcing the package construction. 10 During the inner-lead bonding (ILB) process, such reinforcement can help prevent the cracking of any of the I/O leads. Moreover, during encapsulation process, since the provision of the dummy leads can help reduce the lead gap width at the four corners of the device hole, it can help the encapsulation material to be more evenly distributed to the back side of the semiconductor chip, thus preventing the undesired forming of voids in the resulted encapsulation body, making the resulted encapsulation body less likely to be subjected to popcorn effect and delamination. In addition, it can help provide a uniform package height (UPH) to the overall package construction. These advantages allow the finished TCP product to be more assured in quality and reliability than prior art. 15

20 The invention has been described using exemplary preferred embodiments. However, it is to be understood that the scope of the invention is not limited to the disclosed embodiments. On the contrary, it is intended to cover various modifications and similar arrangements. The scope of the claims, therefore, should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

CLAIMS

What is claimed is:

1. A tape carrier package structure, which comprises:

(a) a semiconductor chip having:

5 (a1) a plurality of I/O pads arranged along the sides thereof; and

(a2) a plurality of dummy pads arranged on the corners thereof;

(b) a tape carrier having a device hole and a plurality of side-situated lead-bonding areas and corner-situated lead-bonding areas surrounding the device hole;

(c) a set of inner leads, including:

10 (c1) a group of I/O leads, which are bonded between the respective I/O pads on the semiconductor chip and the side-situated lead-bonding areas on the tape carrier; and

(c2) a group of dummy leads, which are bonded between the respective dummy pads on the semiconductor chip and the corner-situated lead-bonding areas on the tape carrier.

15 2. The tape carrier package structure of claim 1, wherein the tape carrier is a TAB tape.

3. The tape carrier package structure of claim 1, wherein the semiconductor chip is an LCD driver chip.

4. The tape carrier package structure of claim 1, wherein the I/O pads and the dummy pads on the semiconductor chip are made of aluminum.

20 5. The tape carrier package structure of claim 1, wherein the dummy leads are spaced at substantially the same pitch as the I/O leads.

6. An tape carrier package structure, which comprises:

(a) a semiconductor chip having:

(a1) a plurality of I/O pads arranged along the sides thereof; and

25 (a2) a plurality of dummy pads arranged on the corners thereof;

(b) a tape carrier having a device hole and a plurality of side-situated lead-bonding areas and corner-situated lead-bonding areas surrounding the device hole;

(c) a set of leads, including:

5 (c1) a group of I/O leads, which are bonded between the respective I/O pads on the semiconductor chip and the side-situated lead-bonding areas on the tape carrier; and

(c2) a group of dummy leads, which are bonded between the respective dummy pads on the semiconductor chip and the corner-situated lead-bonding areas on the tape carrier, and which are spaced at substantially the same pitch as the I/O leads.

7. The tape carrier package structure of claim 6, wherein the tape carrier is a TAB tape.

10 8. The tape carrier package structure of claim 6, wherein the semiconductor chip is an LCD driver chip.

9. The tape carrier package structure of claim 6, wherein the I/O pads and the dummy pads on the semiconductor chip are made of aluminum.

10. A tape carrier package structure, which comprises:

15 (a) a semiconductor chip having:

(a1) a plurality of I/O pads arranged along the sides thereof; and

(a2) a plurality of dummy pads arranged on the corners thereof;

(b) a TAB tape having a device hole and a plurality of side-situated lead-bonding areas and corner-situated lead-bonding areas surrounding the device hole;

20 (c) a set of leads, including:

(c1) a group of I/O leads, which are bonded between the respective I/O pads on the semiconductor chip and the side-situated lead-bonding areas on the TAB tape; and

25 (c2) a group of dummy leads, which are bonded between the respective dummy pads on the semiconductor chip and the corner-situated lead-bonding areas on the TAB tape, and which are spaced at substantially the same pitch as the I/O leads.

11. The tape carrier package structure of claim 10, wherein the semiconductor chip is an LCD driver chip.

12. The tape carrier package structure of claim 10, wherein the I/O pads and the dummy pads on the semiconductor chip are made of aluminum.

5 * * * * *

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TAPE CARRIER PACKAGE STRUCTURE WITH DUMMY PADS AND DUMMY LEADS FOR PACKAGE REINFORCEMENT

ABSTRACT OF THE DISCLOSURE

An improved tape carrier package (TCP) structure is proposed, which is characterized in the provision of dummy pads and dummy leads to help reinforce the package construction. The dummy pads are provided on the corners of the semiconductor chip, while the dummy leads are bonded between the dummy pads and corner-situated lead-bonding areas on the tape carrier. During assembly, since dummy leads are bonded between the dummy pads and corner-situated lead-bonding areas, the corners of the semiconductor chip can be firmly supported as well as the four sides of the semiconductor chip which are supported by the I/O leads. As a result, the package construction is reinforced. During inner-lead bonding (ILB) process, such reinforcement can help prevent the cracking of the I/O leads. Moreover, during encapsulation process, the provision of the dummy leads can help allow the encapsulation material to be more evenly distributed to the back side of the semiconductor chip, thus preventing undesired forming of voids in the resulted encapsulation body, making the resulted encapsulation body less likely subjected to popcorn effect and delamination. In addition, it can help provide a uniform package height (UPH) to the overall package construction. These advantages allow the finished TCP product to be more assured in quality and reliability.

* * * * *

FIG. 1A
(PRIOR ART)

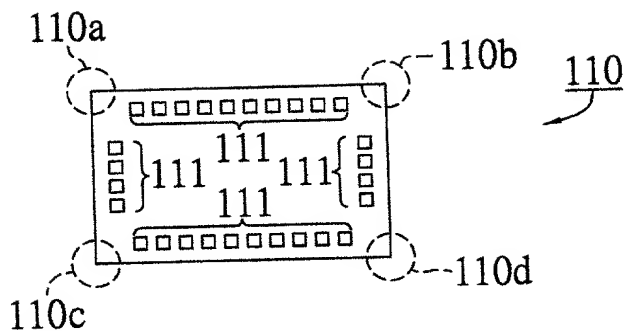


FIG. 1B
(PRIOR ART)

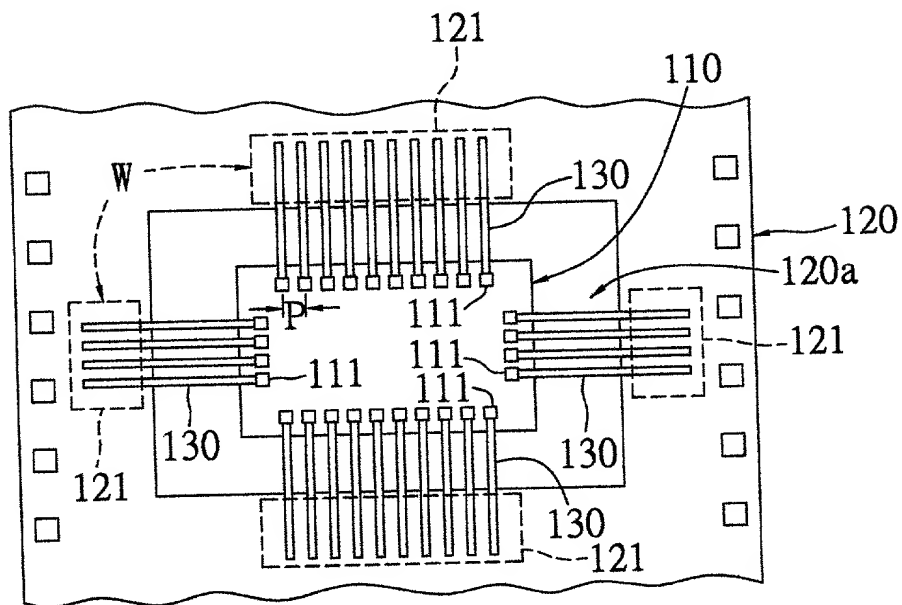


FIG. 1C
(PRIOR ART)

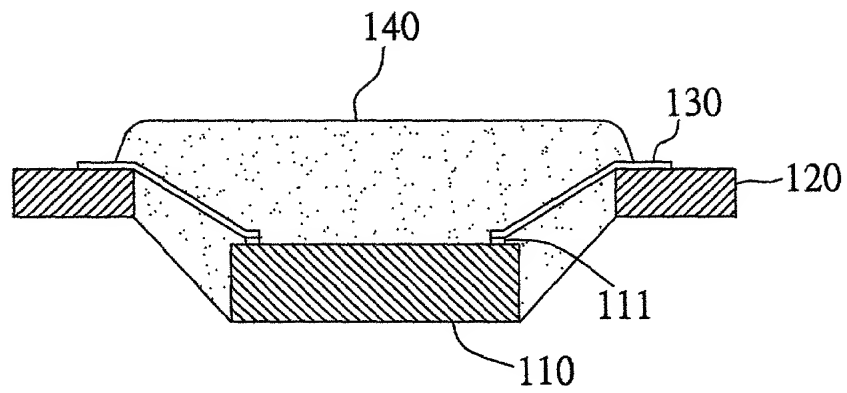


FIG. 2A

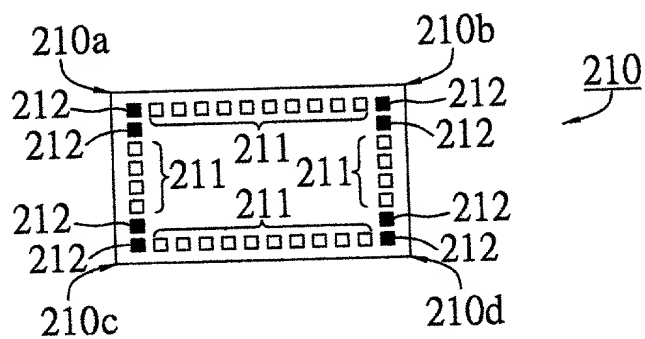
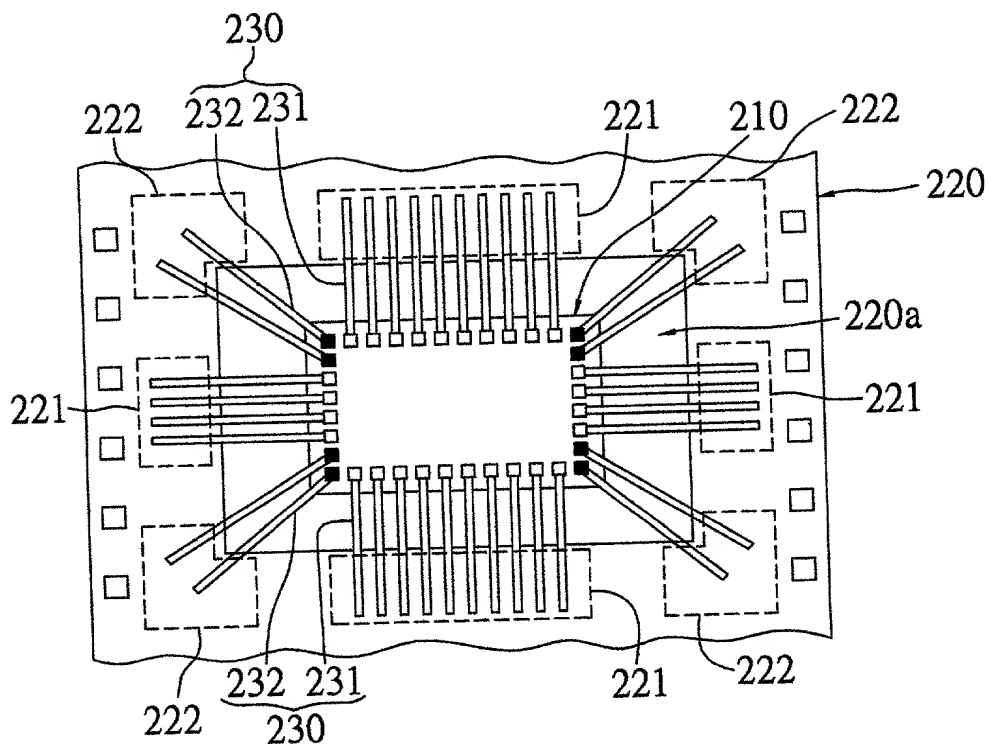


FIG. 2B



Address all telephone calls

Tel: 1-617-523-3400

Address all correspondence to:

Mr. Peter F. Corless

EDWARDS & ANGELL, LLP

130 Water Street, Boston,

Massachusetts 02109-4280, U.S.A

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 USC 1001, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Full name of sole or first inventor Po-Hao YUAN

Inventor's signature PO-HAO YUAN Date Aug 7, 2000

Residence Taichung Citizenship Taiwan, R.O.C.

Post Office Address 15-4F, No.20, Chungkang 2nd Street, Hsintun District,
Taichung, R.O.C.

Full name of second joint inventor, if any Chi-Chuan WU

Second Inventor's signature Chi-Chuan Wu Date Aug 7 2000

Residence Taichung Citizenship Taiwan, R.O.C.

Post Office Address No.1, Alley 33, Lane 82, Pingte Road, Tate Lee, Peitun District,
Taichung, Taiwan, R.O.C.

Full name of third joint inventor, if any Chih-Shun Chen

Third Inventor's signature Chih-shun Chen Date Aug 7 2000

Residence Kaohsiung Citizenship Taiwan, R.O.C.

Post Office Address No.445, Chungching Road, Alian Hsiang, Kaohsiung Hsien,
Taiwan, R.O.C.

Full name of fourth joint inventor, if any _____

Fourth Inventor's signature _____ Date _____

Residence _____ Citizenship _____

Post Office Address _____

Full name of fifth joint inventor, if any _____

Fifth Inventor's signature _____ Date _____

Residence _____ Citizenship _____

Post Office Address _____

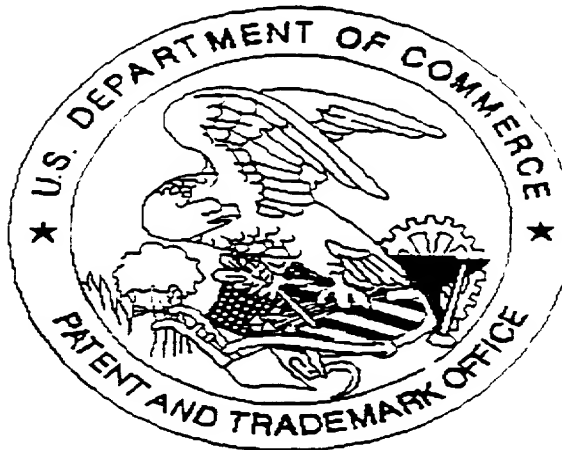
Full name of sixth joint inventor, if any _____

Sixth Inventor's signature _____ Date _____

Residence _____ Citizenship _____

Post Office Address _____

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